

Final report of the AKTION 83p2 project
for the period from 1st January 2019 to 31st December 2019

Basic information

Start date: 15th October 2018

End date: 31st December 2019

Project partners: TU Wien – principal investigator – Prof. Günter Fafilek

BUT – principal investigator – Doc. Ing. Marie Sedlářková, CSc.

Stays of TU Wien employees at DEET BUT FEEC

Günter Fafilek, Dr.A.o. Univ. Prof.

Dates: August 27th to August 28th, 2019 – 1 night, 2 days

November 27th to November 28th

Programme of the visit at BUT:

- a) Summary of Project results to date
- b) Evaluation of results preparation of material samples and their measured properties
- c) Preparation of a joint publication for a reputable journal
- d) Discussion about further cooperation, for example extension of the ACTION project

Martina Ruescher

Dates: July 22th – July 31st, 9 nights, 10 days

During the internship, the student studied cathode (positive) electrode materials for lithium-ion batteries. It focused on methods of synthesis and characterization of lithium iron phosphate (LiFePO₄). This cathode material offers advantageous properties in terms of cyclic life, current carrying capacity and, above all, fire safety. The student prepared this cathode material through solid-state synthesis and subsequently characterized the material by X-ray structure analysis (XRD). These synthesized electrode materials were then submitted to further electrochemical tests. The prepared electrode materials can be used for testing new gel polymer electrolytes.

The student's work is part of a complex work focused on commercial production of lithium-ion batteries.

Benedikt Kossl

Dates: August 19th-August 28th, 9 night, 10 days

During the internship, the student focused on electrochemical characterization of prototype lithium-ion cells. The "pouch" cells were manufactured in Austria on a test line for the production of small-volume lithium-ion batteries. The student used the technique of cyclic voltammetry (CV), galvanostatic cycling (GCPL), with the help of these techniques the student determined the actual capacity and current carrying capacity of individual batteries and compared it with the expected production capacity. The prepared electrode materials can be used for testing new gel polymer electrolytes

The results helped to optimize the test production line for lithium-ion batteries.

Stays of DEET FEEC BUT employees at TU Wien

Doc. Ing. Marie Sedlářiková, CSc; Ing. Miroslav Zatloukal

Dates: October 31st to November 1st 2019, 1 night, 2 days

November 21st 2019, 1 day (only travel cost)

The following issues were addressed during the visits:

- 1 Evaluation and comparison of achieved results of mutual cooperation
2. Evaluation of student stays at both universities in terms of
3. Assessment of publication results
4. Specification of further cooperation in other areas studied at both universities, such as corrosion processes in special metal materials using electrochemical methods
5. Instrumentation has been assessed, with the equipment guaranteeing successful research in this field
6. After the final correction, the final version of the AKTION 2020 Project proposal was agreed

Iuliia Veselkova

Dates : Juni 26th-July 26th 2019

Gel polymer electrolytes with flame retardants were prepared during her stay. Electrochemical properties such as electrical conductivity and potential window were measured for each prepared gel sample. Mechanical properties were also observed for each sample such as elasticity, transparency, adhesion, etc. Then, after comparison, gel samples with better electrochemical properties were

selected for measured thermal properties. Thermal properties of selected samples were measured by TG and DTA analysis. All obtained results are related to the topic of the student's dissertation and were published in the international conference "20th ABAF – Advanced Batteries, Accumulators and Fuel Cells". Also the results will be published in the Journal ECS Transaction.

Summary of achieved project results:

Joint publication:

Veselkova J., Sedlaříková M., Fafílek G., - Gel Polymer Electrolytes Based on Methyl Methacrylate Modified Flame Retardants, ECS Transaction, Vol. 95, No.1, 2019, Page 47-55. ISSN 1938-6737 (on line)

Libich J., Sedlaříková M., Vondrák J., Máca J., Čudek P., Fíbek M., Chekannikov A., Fafílek G. Sodium Titanate Material for Sodium-Ion battery, ECS Transaction, Vol. 95, No.1, 2019, Page 175-181, ISSN 1938-6737 (on line)

Final summary of the results:

1. All points in an approved program were fulfilled.
2. Electrode materials suitable for gel polymer electrolyte tests were prepared during the student stays
3. Polymeric gel electrolytes with different ionic liquids with different contents were prepared conductive salts (Li PF6) and with increased fire resistance
4. Basic parameters were tested with the addition of additives increasing the fire resistance (DTA tests performed)
5. Samples containing nanotubes and heat polymerization in magnetic or electric fields were prepared. The addition of nanotubes has been shown to affect the properties of the resulting electrolyte, but the result is greatly influenced by the preparation conditions. Further research will therefore continue.

These results of joint research of the two universities are promising and the successful cooperation between doctoral and masters students is also beneficial.

These are the reasons why to think about **continuation of the long-term successful cooperation between BUT and TU Wien.**

Doc. Ing. Marie Sedlaříková, CSc.

